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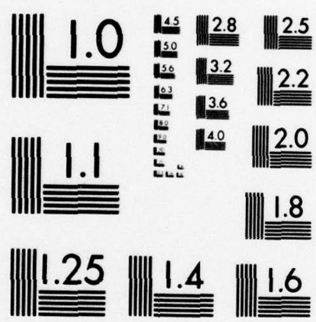


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# STUDY PLAN

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# SEAMOD CONCEPT INVESTIGATION.

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# SEAMOD CONCEPT INVESTIGATION

## EXECUTIVE SUMMARY

### 1. Introduction

The SEAMOD concept envisions the development of Navy surface combatant ships consisting of relatively simple and austere platforms having payload and payload support items that are packaged into modular building blocks which:

- Would be built, checked out, and maintained under factory conditions;
- Could be installed readily in platforms for maximum effectiveness;
- Could permit simple exchanges of given types of payloads; and
- May result in some simplification of the shipbuilding process.

The SEAMOD concept is intended to facilitate the construction, modernization, and conversion of surface combatants by the development of discrete systems modules. The incentive for the modularization of combat systems has been found in various serious problems resulting from current ship design philosophy:

- The disparity between platform life and the effective life of combat subsystems; Advances in technology require frequent changes to the combat systems of naval ships, especially to meet the ever increasing sophistication of potential enemy threats; whereas the hull, propulsion plant, and various support systems are designed to last for many years without major modification. to pg ii

- Conversion of existing ships to accept combat system changes requires large expenditures of money and time; due to:
  - extensive rip-out
  - complex check-out (integrations)
  - extensive software changes
  - changes to support services (power, cooling, etc.)
  - custom work because of the lack of standard interfaces between equipments
- Present practice provides no reasonable means for factory or dockside check-out of the "as installed configuration";
- Every ship conversion is essentially a new design, even among ships of the same class, because of system differences;
- Because of configuration differences, the training of the crew is different for every ship;
- The central data processing concept makes it cumbersome to design and check-out systems made up of components from various manufacturers; and
- Lack of uniformity of interfaces limits equipment substitution without severe ship impact.

2. <u>Background</u>

Numerous reports, memoranda and presentations have addressed the SEAMOD concept as a candidate for active Navy consideration. On 17 August 1973, NAVSHIPS submitted in response to a Chief of Naval Material request a "Proposed Study Plan for SEAMOD Concept Investigation". This plan was developed in concert with all SYSCOMS and proposed a detailed analysis of all facets of the concept. The plan received general acceptance, but implementation was not initiated. On 16 May 1974, NAVSHIPS forwarded to CNM a NAVSHIPS alternate plan to initiate a partial analysis of modular payloads and the prototyping of one modular payload on a test platform to establish preliminary verification of the SEAMOD concept. On 16 July 1974, the CNM forwarded planning recommendations and funding guidance to NAVSEA for revising the study plan of 17 August 1973. Prototyping of modular payloads is to be addressed to CNO at an appropriate

time depending on the study effort progress. This revised plan addresses the 16 July request.

3. Motivating Factors

The Navy is currently confronted with a serious requirement to obtain the maximum return on the resources available for investment in its surface combatant fleet. In dollar amounts these resources are expected to remain at a fairly constant level while the purchasing power of the resources declines. Under these circumstances, it is important to conduct an in-depth evaluation of the SEAMOD concept and its probable contribution toward improving the Navy's return on its investment.

Improvements in the return on investment can be reflected in essentially three ways:

- Increasing the quantity of ships that available resources will acquire and support,
- Achieving optimum effectiveness of the surface combatant fleet, and,
- Obtaining the maximum availability of each surface combatant.

Preliminary staff assessments within the Navy indicate that the SEAMOD concept may contribute significantly in these areas by:

- Simplifying ship construction and combat systems integration.
- Reducing modernization and conversion costs and time
- Reducing overhaul and refit costs via standardized interfaces and rapid refit capabilities
- Accelerating the implementation of advanced technology
- Facilitating frequent mini-modernization
- Permitting the parallel development of combat systems and ship platforms
- Increasing overall RMA for surface combatants.

In addition, the concept may permit more realistic shoreside training of personnel and more effective IOT&E programs by utilizing actual system modules.

Although SEAMOD is considered to be more readily applicable to conventional type hulls, it should be noted that most high performance ships concede a small payload capability while suggesting that fuel can be traded off for different payload requirements. It appears that prepackaged payload mixes capable of rapid installation on high performance hulls could be a future application for SEAMOD.

4. Need for SEAMOD Concept Investigation

Major questions currently deter a decision relating to the degree, if any, to which the Navy should implement SEAMOD concepts in the operational fleet. Among these issues are:

- Potential for SEAMOD application
- Technical feasibility
- Total system costs
- Benefits and penalties derived from SEAMOD
- Impact on fleet acquisition

5. SEAMOD Objective

The objective for the SEAMOD concept investigation is to study the potential military worth of SEAMOD to the Navy and to determine the capability of modular concepts to:

- Capitalize on long platform life
- Minimize impact of short combat system life
- Optimize combatant ship modernity
- Contribute to fleet effectiveness
- Reduce life cycle costs

Study towards this objective will stress:

- Application of SEAMOD packaging
- Impact of SEAMOD on military capability of ships
- Impact of interface issues
- Impact of restrictive military requirements
- Benefits and constraints of SEAMOD interchangeability
- Test information

6. SEAMOD Investigation Approach

The basic approach involves the initial analytical effort addressed in this plan to be followed by a hardware demonstration if justified. The SEAMOD analytical investigation will be defined and bounded by the following parameters:

- Analysis of the DD-963 as the baseline ship
- Development of a life cycle scenario for the DD-963 under conventional and modular configurations
- Definition of principal modular payload candidates
- Packaging of payloads
- Design of a notional modular surface combatant
- Conduct a cost-benefit and risk analysis
- Study schedule and costs

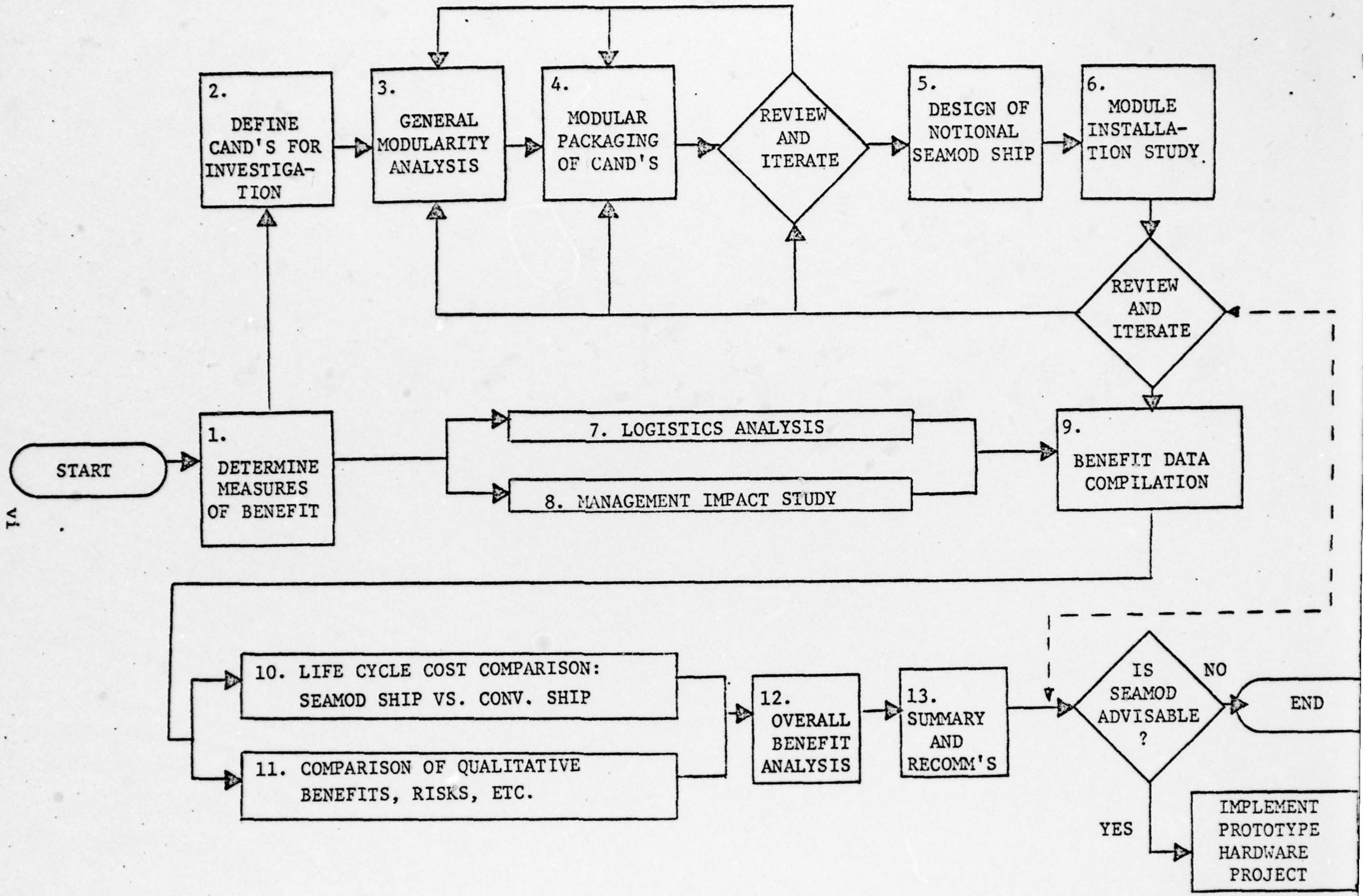
7. SEAMOD Study Tasks

The SEAMOD concept investigation will be performed in two overlapping phases. Phase I will result in the achievement of three goals. These are: (1) the development of detailed criteria and input requirements for the analysis of the military worth of the SEAMOD concept; (2) the development of substantive initial estimates of the military worth potential which might be attainable through implementation of the SEAMOD concept; and, (3) the technical feasibility portion of the investigation. Phase I will develop SEAMOD preliminary ship designs and provide the necessary data for the performance of Phase II life cycle costs and cost-benefit-risk analyses of the SEAMOD concept. Phase II also includes the development of conclusions and recommendations, and (if appropriate) the preparation of a follow-on SEAMOD Concept Test and Development Plan.

The ultimate success of SEAMOD will involve changing the present method by which the Navy conducts its business and will also rest on certain key issues which this study will attempt to identify and resolve. These are:

- Overall military worth
- Life cycle costs
- Combat systems integration
- Logistics impact

A functional overview of the study plan tasks is shown at page vi.




SEAMOD INVESTIGATION - FUNCTIONAL OVERVIEW

## 8. Organization, Management, Scheduling and Funding of SEAMOD Concept Investigation

This investigation will be performed in two phases by the Commander, Naval Sea Systems Command, who will provide overall sponsorship and coordination of the SEAMOD Concept Investigation. He will appoint a full time SEAMOD Study Director. Systems Commands will participate in study tasks to the extent that their cognizance, expertise and responsibility are warranted. The investigation will be conducted over an 27 month period and is estimated to require $3.965 million dollars. It is presently contemplated that FY75 funding requirements will be provided by NAVMAT and allocated to program participants by the NAVSEA Study Director. FY 76 and FY 77 funds will be budgeted by the participating SYSCOMs in coordination with NAVSEA planning guidance and the recommendations of the SYSCOM representatives assigned to the study team.

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SECTION I

## 1.0 INTRODUCTION

The SEAMOD concept envisions the development of Navy surface combatant ships consisting of relatively simple and austere platforms whose payload and payload support items are packaged into modular building blocks which would be built and checked out under factory conditions and which could be installed readily in those ships. It is intended to permit relatively simple exchanges of a given type of payload, and between different types of payloads.

This proposal presents a plan for the active investigation of the SEAMOD concept by the Navy.

### 1.1 Background and History

Numerous reports, memoranda and presentations have addressed the SEAMOD concept as a candidate for active Navy consideration. The Combat Systems Advisory Group (CSAG) was actively addressing SEAMOD in its fulfillment of the CNM's charge that the group undertake topics and systems which will dramatically impact the direction of the Navy in the future. The principal document compiled by CSAG on the SEAMOD concept is the SEAMOD Executive Notebook, which describes the numerous, varied modularization applications available for consideration by the Navy.

On 21 May 1973, a letter directed to the Commander, Naval Ship Systems Command (COMNAVSHIPS), from the Office of the Chief of Naval Material, recognized the previous work of CSAG and called for the development of a plan which seeks an in-depth technical feasibility investigation to assess and evaluate the military value of the SEAMOD concept to the Navy. NAVSHIPS responded with a "Proposed Study Plan for SEAMOD Concept Investigation" dated 17 August 1973. The proposed study plan was not implemented and NAVSHIPS subsequently submitted an alternate plan to

investigate the SEAMOD concept using analysis and a prototype hardware demonstration. A comparison of the two alternate approaches was reviewed by NAVMAT and NAVSHIPS. This review indicated that the original approach offered the best methodology to determine the potential benefits of SEAMOD to the Navy. If the detailed analyses of the concept warrant, a follow-on hardware demonstration will be initiated at a later date.

This plan is a revision to the original submission of 17 August 1973. It has been revised and updated to conform to NAVMAT guidance and the approaches recommended by the SYSCOMS concerned.

## 1.2 Motivating Factors

Some of the factors which now motivate the Navy to scrutinize SEAMOD potential in realizing military mission objectives are listed below.

### 1.2.1 Need to Improve Fleet Readiness and Capability

The ability of the Navy to maintain the fleet in an on-the-line, combat-ready posture is of paramount concern. The SEAMOD concept may provide a feasible and desirable means of improving the present situation and provide advantages in fleet readiness, shipbuilding and maintenance practices. Current considerations include:

- The Navy currently must sustain high ship acquisition and maintenance costs.
- Ship conversion and modernization are characterized by high cost and prolonged off-the-line time periods. This suggests that modernization of capabilities may occur too infrequently, given the accelerating state-of-the-art technology, to maintain a ship at its required military capability.
- The Navy must currently sustain high manning levels and lengthy training periods.
- The changing nature of naval warfare suggests a need to rapidly change ship mission capability.

### 1.2.2 Commercial Utilization of Containerization

The commercial shipping industry continues to benefit from the containerization cargo concept. Containerization significantly lowers shipping costs, encourages rapid loading and unloading, reduces manpower necessary to more cargo, and increases the efficiency of shipping lines. Distinct advantages may accrue to the Navy from the commercial shipping containerization experience.

### 1.2.3 Flexibility of Containerized Payloads

Considered in the broadest context, containerization encompasses more than a single size container. The 8' x 8' x 20' standard sized container is but one of many whose sizes, weights and functions represent a wider, more divergent array of modular possibilities. The most effective SEAMOD application may involve modules large enough to be structural entities of ships, or small enough to be manually slid in and out of larger units.

### 1.2.4 Use of Commercial vice Military Specifications and Equipment

Military utilization of commercial specifications and equipments has been shown to be militarily acceptable and economically advantageous in selected applications. Further exploitation of commercial specifications for this application could result in significant cost savings. To this end the SEAMOD study will review civil applications and studies such as the study by the U.S. Maritime Administration.

## 1.3 Need for SEAMOD Concept Investigation

This investigative effort will ensure that benefits and penalties are useable inputs for consideration by the decision maker and that associated risks are documented in a meaningful manner. This plan recognizes these factors, and will detail, in the course of the investigation, information in the following typical categories:

- Specific military benefits to accrue. Measures of benefit deriving from SEAMOD, and accruing therefore to the Navy, are the criteria by which SEAMOD ultimately will be evaluated. Measures of benefit will be defined early in the study, and will continue to be scrutinized to the degree that pertinent information resulting from other ongoing activities becomes available.
- Technical feasibility. Conceptually, it appears feasible that warships can be designed to dimensionally accept mixes of type modules. However, a wide variety of interface and seaworthiness problems are recognized and need to be identified and resolved in order to establish the technical feasibility of designing modular warships.

  Additionally, the study of the interfaces among the various combat subsystems would be of immense benefit to the Navy regardless of the ultimate implementation of the SEAMOD concept. These interface techniques may be equally applicable to a SEAMOD or conventionally designed ship.
- Total systems costs. The SEAMOD concept will impact not only the operational forces, but also the total Navy support establishment. A total system cost analysis has not been addressed to date. This proposal sets forth the comprehensive approach to determining all pertinent decision making cost factors. Cost, manpower and time constraints obviously pre-empt undertaking a study which is expected to produce blueprints for a completely modular ship and supporting shore establishment. Instead, the study is held to an in-depth analysis of those factors which will identify positively the desirability of implementing SEAMOD on a significant scale.

* <u>Overall benefits and penalties of the program.</u> Description of the overall benefits of implementing modularization is obviously crucial to a positive SEAMOD program. However, associated risks and penalties are an important part of any major decision making process, and will be explored during this effort. The true military worth of SEAMOD will be defined in terms of positive trade-offs between explicitly structured benefits and penalties.

SECTION II

## 2.0 SEAMOD CONCEPT INVESTIGATION OBJECTIVE

The objective of the study is to determine the military worth of the SEAMOD concept to the Navy and provide the necessary information to justify a decision implementing modular ship design. Discussion of major considerations follows.

### 2.1 Applications of SEAMOD Packaging

Investigations of applications and applicability of modularization to existing military missions of surface combatants will yield weapon systems equipments which are amenable to SEAMOD packaging. Overall military value will be measured by the specific operational benefits which result from mission equipments amenable to the SEAMOD concept.

### 2.2 Impact of SEAMOD on the Military Capability of Ships

The military capability of ships in the fleet is a critical factor which is evaluated in terms of time on-the-line, effectiveness of mission equipment, and modernization and maintenance routines. This capability may be examined in terms of the following:

- Seaworthiness
- Ship size
- Total ship weaponry
- Mission capability (both of the ship and of weapon equipment)
- Economic cost savings
- Survivability in combat

### 2.3 Impact of Interface Issues

A substantial portion of the investigation and the entirety of the feasibility and success of SEAMOD rest on positive resolution of the

interface and systems integration problems associated with the implementation of the SEAMOD concept. Interface problems involved in the use of a single configuration of military packages on a ship, and both partial and full changes to that configuration (weapons, sensors, command and control, ASW, AAW, anti-surface applications), represent extremely important inputs to the decision making process.

Successful modularization requires simplification and standardization of interfaces among subsystems comprising a combat system. If the SEAMOD concept of modularization is implemented without adequate attention to today's more complex interface and systems integration problems, the problem of implementing a viable modular design may become staggering.

### 2.4 Impact of Restrictive Military Requirements

The decision making process may be influenced by currently imposed military requirements. To improve the military value of the SEAMOD concept to the Navy, these requirements may have to be modified or eliminated.

### 2.5 *Impact of Benefits and Constraints of SEAMOD Interchangeability*

The SEAMOD concept proposes interchangeability deriving from modularization. This presents a new dimension of flexibility to the Navy in meeting mission requirements. The decision maker will need to know the benefits and constraints that the interchangeability feature of the SEAMOD concept might pose on current and future developmental equipment.

### 2.6 Test Information

Tests which might be appropriate to demonstrate the worth and practicability of the SEAMOD concept will be identified.

SECTION III

## 3.0 SEAMOD INVESTIGATION APPROACH

The SEAMOD investigation must be bounded by a number of parameters which set the study direction and which define the content of the study tasks appearing in Section IV.

### 3.1 Selection of Candidate Ships

The investigation will consider one ship type as a basic unit. The DD-963 has been selected for the study because it is a modern surface combatant and is representative of basic surface combatant requirements for modernization, conversion, and overhaul. Further, it is anticipated that timely cost data will be available from current records.

### 3.2 Development of Life Cycle Scenario

A life cycle scenario will be developed during the investigation against which the conventional and a notional modular DD-963 ship may be compared for cost, risk and military benefits. The scenario is not envisioned to be a full scale combat scenario, but rather a vehicle for plotting the best estimates of the maintenance cycles and modernization procedures that would be conducted for the DD-963. In particular, the scenario will provide for major ship combat systems changes.

### 3.3 Definition of Principal Modular Payload Candidates

Principal modular payload candidates will be identified and defined to the ships payload using approved CNO ships characteristics, where available. It is the intent in the comparison of modular and conventional ship design that combat mission hardware be identical (except for packaging in the ship) or directly comparable.

## 3.4 Packaging of Payloads

Military mission payloads may be packaged in four module types:

- Large scale construction modules
- Large scale functional modules
- Containers
- Palletized modules

Emphasis will be placed on the replaceable, mission capable modules appropriate to the size and life of the modularized ship, within the constraints of CNO-approved missions.

SEAMOD modularization may involve considerably more flexibility than is afforded by a single sized module. A large scale construction module is an enormous, structural piece of a modular ship, housing several weapons systems and including ship functions ranging from messing to command and control. A large scale functional module is a large unit which may be readily installed or removed from the ship but is not readily transportable as a unit. Containers are standard sized units which consolidate systems conventionally placed aboard ship in piecemeal style. Palletized modules are able to slide in and out of larger modules or containers.

## 3.5 Designs of Notional Modular Ships

Notional modular ship design of the DD-963 type will be developed. A comparative analysis of the baseline DD-963 will be made in the present (conventional) and modular configurations. Included in this comparative analysis will be modernization and conversion studies for DD-963 using identical future mission equipments for both the conventional and modular ships.

## 3.6 Scope of Design Effort and Feasibility Analysis

The design effort and feasibility analysis will be performed only in sufficient detail to permit development of adequate Class F cost

information to establish technical feasibility, to highlight potential risks and to measure military benefit potential.

## 3.7 Conduct of Cost-Benefit and Risk Analyses

Cost-Benefit and risk analyses will be performed in a quantitative mode where feasible. Where direct measurement of costs or benefits cannot be made, these analyses will be performed qualitatively. Comparison of the modular and nonmodular ships will be made on a total, life cycle basis, including impact on shore and other ship and aircraft support systems.

## 3.8 Study Schedule and Costs

The SEAMOD concept investigation will be completed in twenty-seven (27) months following initiation. The estimated cost of the SEAMOD concept investigation is $3.965 million dollars. Because of this large cost, five (5) special program reviews are scheduled at points which are 3, 6, 12, 18 and 22 months into the investigation.

The schedule of tasks is specifically tailored to provide at these points early indicators of increasing maturity and sophistication with respect to the potential value of continuing the investigation.

SECTION IV

4.0 SEAMOD CONCEPT INVESTIGATION STUDY TASKS

4.1 TASK 1 DETERMINE MEASURES OF BENEFIT

4.1.1 Objective

The objective of this task is to identify and formulate measures which allow an assessment of real and potential benefits accruing to the Navy from SEAMOD.

4.1.2 Description

Subtasks contained herein include:

1. Develop a life cycle scenario for the DD-963 to include:
   - Major equipment change cycle
   - Rate of mission conversion
   - Rate and length of overhauls and repairs
   - Rate of casualty repair/module replacement
   - Rate of equipment calibration
2. Determine measures of fleet readiness in terms of ship on-line availability under the following conditions:
   - Routine maintenance
   - Shipyard availability (overhaul and repair)
   - Battle damage to module and ship
   - Average individual ship military effectiveness
3. Determine measures which will allow an assessment of benefits to be derived from:
   - Potential of extensive pre-installation checkout of modules

- Potential of early Developmental and Operational T&E of modular assets
- Capability for use of modular assets ashore

### 4.1.3 Responsibility

The Study Director will retain prime responsibility for determining the measures of benefit and compiling the inputs from the several Systems Commands.

## 4.2 TASK 2 DEFINE CANDIDATES FOR SEAMOD INVESTIGATION

### 4.2.1 Objective

The objective of this task is to define mission and function related elements (payload) and payload support equipment for modular analysis of the DD-963. The DD-963 will be addressed in the baseline (as currently designed), and modernized and converted configurations.

### 4.2.2 Description

Subtasks contained herein include:

1. Identify ship functions and missions involving potentially modular equipments/combat systems.
2. Define equipment suites related to each ship function and mission in both direct and supporting roles.
3. Establish tentative equipment groups for assembly into individual module packages. Consideration shall be given to:

    - Constraints in the location on the ship of conventional equipments
    - Impact of proposed modernization and conversion plans
    - Grouping by ship function or mission
    - Common requirement among several ship functions and/or missions

4. Prepare design data and cost data on the conventional ship alternatives.

### 4.2.3 Responsibility

Each Systems Command will be assigned responsibility by the Study Director to identify ship functions and missions, to define related equipment suites, and to establish the tentative module groups and

cost data on the conventional ship design alternatives appropriate to its area of naval hardware and equipment. The overall responsibility for compiling and coordinating the inputs from the several Systems Commands will be assigned to NAVSEC.

### 4.2.4 Discussion

This task will assure a common basis for comparison when assessing the merits of the SEAMOD modular concept vis-a-vis current conventional approaches to the design and development of naval ships. Equipment components, which constitute given mission or function capability levels in each individual alternative (type/variant), will be used, unchanged, throughout the study for the modular versions of the ship alternatives and the conventional versions of the ship alternatives.

## 4.3 TASK 3 GENERAL MODULARITY ENGINEERING ANALYSIS

### 4.3.1 Objective

The objective of this task is to establish the modularity imposed physical layout, engineering constraints, and standard interface parameters for the candidate modules identified by Task 2.

### 4.3.2 Description

Subtasks contained herein include:

1. Develop physical layouts of candidate modules, including:

   - Physical dimensions
   - Weight limitations
   - Internal equipment layout
   - Grouping of individual modules to form a functional module
   - Adapting individual modules to the standard grid

2. Develop engineering constraints, including:

   - Service requirements (electrical, environmental)
   - EMI/EMC
   - Transportability

3. Develop standard interface parameters, including:

   - Establishment of grid dimensions
   - Intramodule
   - Module to module:
     - System/subsystem information interfaces comprising information rates and information formats

- Cross military mission interfaces (communication equipment support required for information transfers)
- Intermodular cable runs, connection and power interfaces
- Mechanical interfaces, such as physical strength and stability

- Module to ship:
  - Electrical, including HVAC
  - Environmental
  - Mechanical, including structural foundations and shock isolation

4. Study combat system information exchange techniques. This would cover localized, versus centralized processing and parallel to serial and serial to parallel conversions of the information, both at the intramodule and intermodule interface levels.

### 4.3.3 Responsibility

The prime responsibility for establishing the physical layouts, engineering constraints, and standard interface parameters, and compiling the inputs from the other Systems Commands, will be assigned to NAVSEC except for the combat system information interface parameters. NAVSEA will be assigned the responsibility of establishing and compiling the inputs from other Systems Commands for the combat system information interface parameters.

### 4.3.4 Discussion

Modularization will require a simplification and standardization of ship subsystems, which combine to comprise an integrated combat system. The standardizing precepts developed in this task will serve to govern

the detailed feasibility analysis developed in Tasks 4, 5, and 6 of this SEAMOD investigation and lead to an integrated combat system.

## 4.4 TASK 4 MODULAR PAYLOAD PACKAGING AND DESIGN

### 4.4.1 Objective

The objective of this task is to package the payload elements (and, possibly, associated payload support elements), as identified and defined in Task 2, into modular elements in accordance with concepts, principles and standards developed in Task 3.

### 4.4.2 Description

Subtasks contained herein include:

1. Perform tradeoffs between various modular package configurations and sizes (container, pallet, etc.) considering type of payload and location on ship.
2. Optimize module structural arrangement for ruggedness for lifting, transporting and seaworthiness after installation.
3. Define requirements in the area of systems compatability where modules/containers will be physically co-located and/or functionally integrated.
4. Provide tolerances in the area of system alignment which will be required of weapons systems modules/containers.
5. Provide restrictions on separation of system modules (antenna distance from transmitter, launcher location in respect to magazine, etc.).
6. Compare payload support requirements for alternative mission payload packages for essentially common elements.

4.4.3 . <u>Responsibility</u>

NAVSEC will be assigned the responsibility for the module structure, its attachment to the ship and all platform related interfaces. Responsibility for interfaces between payload elements will rest with and be shared by those Systems Commands cognizant of the respective payload elements.

4.4.4 <u>Discussion</u>

Where substantial commonality is determined, inclusion of these support elements as permanent elements or special modules of the platform will be considered, unless rapid technological advances may create early obsolescence. Centralized support (and the associated need for an extensive distribution network) will be traded off against integration of payload and support elements (direct functional mechanization).

## 4.5 TASK 5 DESIGN OF A NOTIONAL SEAMOD SHIP

### 4.5.1 Objective

The objective of this task is to design in an optimum manner a notional modular DD-963 which accommodates and functionally integrates the modular payload packages established in Task 4.

### 4.5.2 Description

Subtasks contained herein include:

1. Develop a notional baseline ship design.
2. Adapt the modular grid pattern into an overall ship configuration.
3. Assess the impact of modular rapid refit features on ship structural configuration, minimizing duplication between ship and module structure.
4. Assess the impact on topside configuration and related problems (clutter, EMI, RFI, etc.).
5. Develop methods of providing distribution centers for services and service access (including personnel and damage control).
6. Determine shipping, handling, and access requirements for modular components.
7. Determine alignment/arrangement requirements for modular weapon system components.

### 4.5.3 Responsibility

NAVSEC will be assigned the responsibility for developing the ship platform designs and will maintain close liaison with the other Systems Commands.

### 4.5.4 Discussion

A variety of different platform configurations will be developed to allow recommendation of a notional SEAMOD baseline ship design which best supplements and enhances the overall SEAMOD potential. Care will be taken to provide equal mission performance capability for the modular ship alternatives as is provided on the conventional DD-963.

## 4.6 TASK 6 INSTALLATION OF MODULAR PAYLOAD ON SEAMOD SHIP PLATFORMS

### 4.6.1 Objective

The objective of this task is to substantiate the interface standards developed in Task 3, the modular packaging concepts developed in Task 4 and the SEAMOD ship concept developed in Task 5 by performing a detailed study of the process of mating payload and platform.

### 4.6.2 Description

Subtasks contained herein include.

1. Analyze the process of:
   - Movement of the modules on and off the ship
   - Attachment of module structure to the ship structure
   - Hook-up of physical interface connections (cabling, piping, ducting, etc.)
   - Check-out of system after installation
2. Determine estimated time required for the above installation and refit phases.
3. Assess the impact of shipboard test requirements.
4. Carefully record all potential technical problems foreseen, and identify alternate solutions to these problems.

### 4.6.3 Responsibility

The prime responsibility for the SEAMOD module installation study will be assigned to NAVSEC.

### 4.6.4 Discussion

It is anticipated that iterations will be required which possibly may involve Tasks 4, 5 and parts of Task 3. These iterations will allow utilization of added insight for improved modularity standards, module configurations, and a more efficient modular ship platform.

## 4.7 TASK 7 CONDUCT LOGISTICS ANALYSIS

### 4.7.1 Objective

The objective of this task is to identify and quantify the impact of the SEAMOD concept on the logistics elements, both afloat and ashore, for the life cycle of the modular ship. Full consideration to be given to ILSP practices and procedures.

### 4.7.2 Description

Subtasks contained herein include:

1. Determine the probable logistics structure in being for the life cycle of the ship class.

2. Assess and quantify, where practicable, the changes to logistics elements imposed by SEAMOD and identify the potential benefits and penalties thereof, including the following areas:

   - Personnel
   - Training
   - Spares
   - Transportation
   - Maintenance
   - Storage
   - Inspection
   - Handling

### 4.7.3 Responsibility

The prime responsibility for determining the changes to the existing logistics systems will be assigned to the Naval Supply Systems Command.

## 4.8 TASK 8 IDENTIFY SEAMOD IMPACT ON NAVY INTERNAL MANAGEMENT

### 4.8.1 Objective

The objective of this task is to identify the impact of the SEAMOD concept on the Navy's conventional management procedures.

### 4.8.2 Description

The task will identify and assess the impact of changes to the Navy's way of doing business, imposed by SEAMOD in the following areas:

- Acquisition
- Maintenance
- Testing
- Development
- Modernization and overhaul
- Logistics

### 4.8.3 Responsibility

The prime responsibility for identifying the impact of the SEAMOD concept on managment procedures will be assigned to each Systems Command, and will be coordinated by the Study Director.

### 4.8.4 Discussion

This task will be general only; its contents will be developed primarily from fallout from other tasks. Subsequent detailed study effort may be desired to determine specifics.

## 4.9 TASK 9 COMPLETE DATA FOR COST, BENEFIT, AND RISK ASSESSMENTS

### 4.9.1 Objective

The objective of this task is to compile quantitative data, and to list all qualitative factors, developed during Tasks 1-8.

### 4.9.2 Description

Subtasks contained herein include:

1. Identify planned data output with the associated schedules.
2. Establish data formats such that all Systems Commands conform to and submit similar inputs.
3. Develop and maintain a data identification system file structure, and storage and retrieval system, for generated data.

### 4.9.3 Responsibility

Prime responsibility for compiling all quantitative and qualitative data will be assigned to the Study Director. Inputs will be provided by all Systems Commands as directed.

### 4.9.4 Discussion

This compilation will be based on measures of benefit criteria established in Task 1, and will form the data base for the systems analyses of the study. The structured data base will receive and store all data generated in the preceding tasks.

4.10 TASK 10 DETERMINE THE LIFE CYCLE COSTS FOR COMPARABLE MODULAR AND CONVENTIONAL SHIP DESIGNS

4.10.1 Objective

The objective of this task is to develop comparable life cycle costs for both modular and conventional ship designs.

4.10.2 Description

Subtasks contained herein include:

1. Develop a life cycle profile for costing which is based on the life cycle scenario of Task 1, and which incorporates initial development and procurement as well as operational, maintenance, support and system improvement aspects of ship life.

2. Develop a cost breakdown structure defining each element to an appropriate cost estimating level such that comparable costs for modular and conventional designs can be assembled.

3. Develop methodologies for estimating cost elements to insure a common basis of comparison between the conventional and modular ship.

4. Estimate element costs or cost differences, as appropriate.

5. Develop the cost model based on the life cycle profile to include considerations of standard cost factors, external support facilities, discount and escalation factors, and special features (e.g., commissioning costs, new training, documentation, etc.)

6. Compile life cycle costs, using the cost model.

4.10.3 Responsibilities

The Study Director will retain prime responsibility for the development of the life cycle profile, methodology and cost model. He will be assisted by several Systems Commands in the development of the cost breakdown structure and element cost estimating.

### 4.10.4 Discussion

Close direction and coordination by the Study Director will be required to assure cost estimating and modeling is performed on an equitable basis. Commonly applied assumptions must be employed. The cost breakdown must include as many external elements as can be developed to insure that the total "Costs to the Navy" are applied. These must include facilities for maintenance and logistics, such as shipyards, tenders, depots, etc. A special cost estimating team will be employed to monitor and coordinate this effort because of the unusual scope and nature of this cost estimating task.

## 4.11 TASK 11 DETERMINE SUBJECTIVE TRADEOFF CONSIDERATIONS (RISK, UNCERTAINTIES, POTENTIAL BENEFITS)

### 4.11.1 Objective

The objective of this task is to identify and analyze those pertinent subjective considerations related to the SEAMOD concept.

### 4.11.2 Description

Subtasks contained herein include:

1. Develop a methodology which permits an assessment of the considerations, factors, and issues which do not lend themselves readily to a quantitative tradeoff.

2. Develop all elements of risk pertinent to the SEAMOD concept in order to be able to compare modular risk factors.

3. Expand and relate the various advantages and disadvantages encountered in Tasks 3-8, which are not fully included in Tasks 9 and 10.

4. Evaluate tactical and other advantages to be derived from the SEAMOD concept, such as:

   - Mission interchangeability of the SEAMOD ship providing the single mission option without significant tactical risk
   - Improved adaptability to changing threats
   - Improved potential of capitalizing on technological breakthroughs

5. Determine nonquantifiable parameters associated with engineering development, acquisition management, ship construction, operational and support life (including operational force planning, force structures, etc.) which may represent positive or negative benefits of the SEAMOD concept.

6. Examine each benefit parameter derived, with regard to the SEAMOD concept versus conventional practices. This examination will be carried to sufficient detail to rationalize ad-

vantages and disadvantages that relate to SEAMOD.

### 4.11.3 Responsibility

The Study Director will retain the prime responsibility for determining the subjective tradeoff considerations. The Study Director shall coordinate all Systems Command inputs as he determines necessary.

## 4.12 TASK 12 OVERALL COST-BENEFIT-RISK ANALYSIS

### 4.12.1 Objective

The objective of this task is to combine the results of Tasks 9,10 and 11 into an integrated overall representation of weighted benefits and risks related to costs.

### 4.12.2 Description

Subtasks contained herein include:

1. Develop the methodology for the performance of the SEAMOD system analysis.
2. Compile, synthesize and analyze the output of Tasks 9, 10 and 11.
3. Prepare a summary report containing a concise description of the overall networth and practicability of the SEAMOD concept with respect to specific mission and functional areas.
4. Distribute this summary report to all Systems Commanders.

### 4.12.3 Responsibility

The prime responsibility for this task is retained by the Study Director.

## 4.13 TASK 13 DEVELOP CONCLUSIONS AND RECOMMENDATIONS

### 4.13.1 Objective

The objective of this task is to develop a joint Systems Command position in regard to the SEAMOD concept.

### 4.13.2 Description

Subtasks contained herein include:

1. Conduct a Systems Command critical review and evaluation of the results of the SEAMOD evaluation with particular attention to the summary report prepared by the study team in Task 12.
2. Determine whether the results are positive.
3. Develop a joint inter-Systems Command position with respect to the SEAMOD concept. This is to include (providing the results are positive) the preparation of a plan for the SEAMOD concept demonstration and program development.

### 4.13.3 Responsibility

The prime responsibility for this task will be assigned to the Study Director.

## SECTION V

## 5.0 ORGANIZATION MANAGEMENT, SCHEDULING AND FUNDING OF SEAMOD CONCEPT INVESTIGATION

### 5.1 Organization

The overall sponsorship and coordination responsibilities for the SEAMOD Concept Feasibility Study shall be vested in the Commander, Naval Sea Systems Command. A Study Director shall be designated by the Commander, Naval Sea Systems Command and shall be responsible for the overall direction and guidance of the SEAMOD Feasibility Study and for the day to day coordination of effort among the various Systems Commands. The organization and staffing of the office of the Study Director will be determined by COMNAVSEA.

The Director shall be assisted by a study team consisting of representatives of each of the several Systems Commands. The individual study team members shall be both the principal points of contact and the coordinators of the study effort conducted by the respective Systems Command and and participating activities.

The Systems Commands will provide the required staffing and inputs necessary for the performance of the study. This will require the assistance of various naval field activities and of contractors.

The SEAMOD organizational relationships are illustrated in Figure 5-1.

### 5.2 Study Management

#### 5.2.1 General

The SEAMOD program will proceed as an analytical technical development with designated organizations carrying out detailed engineering and analyses under the overall management of the NAVSEA Study Director.

All subordinate planning and developments are to be specified and coordinated by the Study Director to produce an integrated study that conforms to the program objectives. The Study Director will issue planning guidance and system requirements to participating organizations and approve their proposed plans, schedules, funding requirements, and technical specifica-

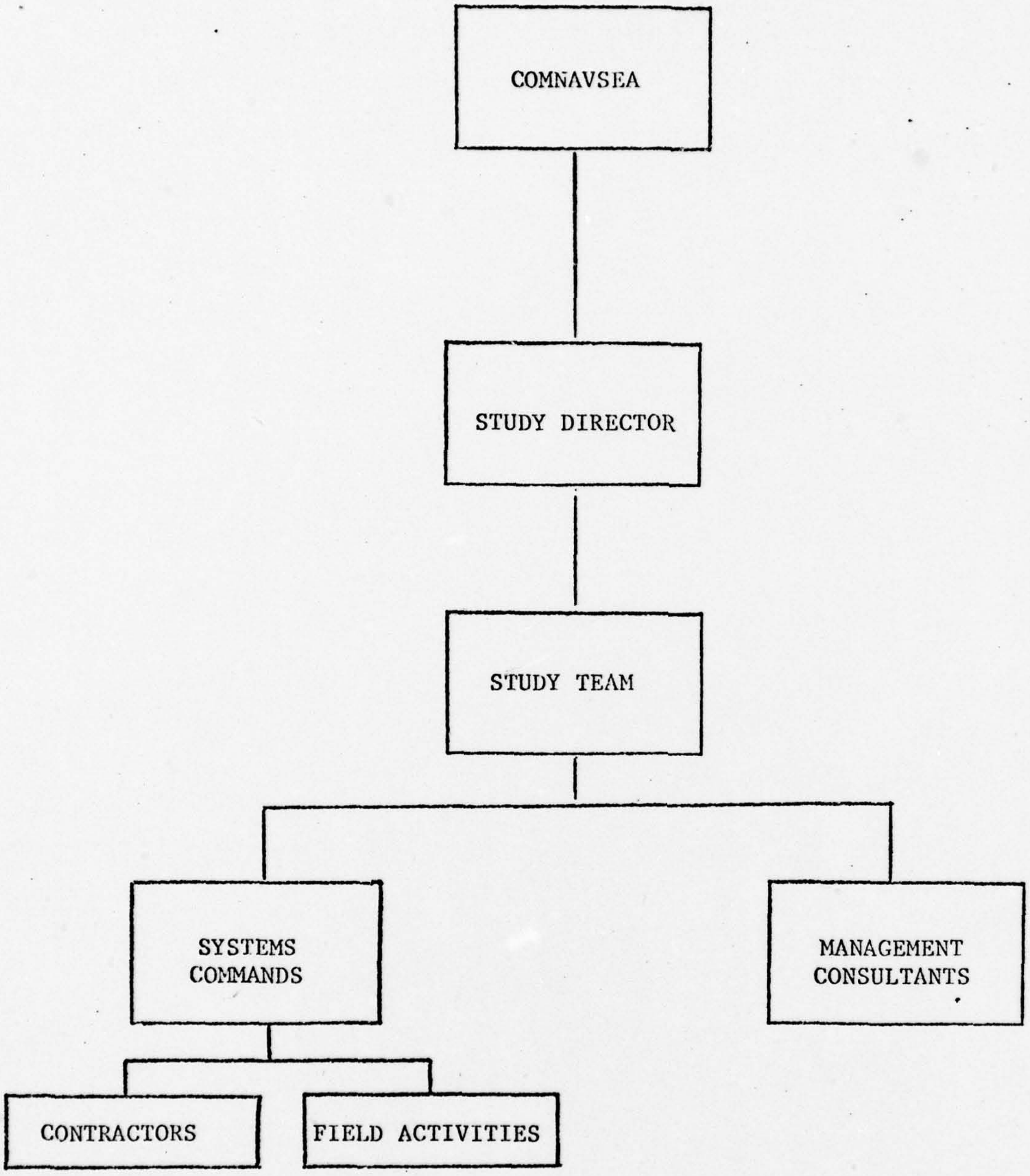



FIGURE 5-1 SEAMOD FEASIBILITY STUDY ORGANIZATIONAL RELATIONSHIPS

tions for subsystem developments.

The Study Director's office will address two major functional activities: Program Management, dealing with the planning, control and documentation of the project; and System Analysis and Engineering to ensure technical validity.

### 5.2.2 Planning Analysis

A detailed analysis will be made by the Study Director of the SEAMOD implementation summarized in this plan to determine what plans will be required to ensure that project objectives and goals are achieved. The analysis will develop scope, depth of treatment and time frame for additional plans to be prepared by participating SYSCOMS.

### 5.2.3 Planning Guidance Memorandums

The Study Director will issue Planning Guidance Memorandums (PGM) to project participants to specify tasks, technical criteria, schedules, resources, etc. to be used in the development or revision of subordinate plans and activities.

### 5.2.4 Plan Preparation

The Study Director will prepare overall planning documents for the SEAMOD study as an integrated effort. These plans will include technical, analytical, scheduling, funding plans, and other plans as determined during the Planning Analysis. The Study Director may require inputs from study participants to be integrated into overall plans.

### 5.2.5 Tasking

The Study Director will define and publish all program level tasks. Tasks may be issued as part of a published plan or as a PGM.

### 5.2.6 Schedules

System level milestone and/or network schedules will be issued by the Study Director based on planning guidance received from higher authority or approved inputs from program participants.

### 5.2.7 Program Control

The Study Director will establish control procedures to ensure surveillance over program activities and progress. Control procedures will include performance monitoring, schedules, and tasks; Work Breakdown Structures; Management Information System; Reports; In-Process Reviews; etc.

### 5.2.8 Coordination

The Study Director will be the program level coordination authority. Ample latitude will be allowed for direct technical coordination among participants with the Study Director being informed of major agreements made.

### 5.2.9 Documentation

The Study Director will promulgate a comprehensive SEAMOD Documentation Plan which prescribes and codes the array of documents to be published at the program level. Documents prepared by program participants may be incorporated into the plan as program level documentation.

### 5.2.10 Data Management

The Study Director will prescribe specific management and technical data required to be generated by program participants for the SEAMOD final report and specific studies and plans.

### 5.2.11 Resources Management

Each program participant will be responsible for determining the funding requirements for his efforts. The Study Director will conduct overall program resources planning.

## 5.3 Scheduling

The SEAMOD concept investigation will be performed in two phases in a twenty-seven (27) month period over fiscal years 1975-77. A functional overview schedule displaying the interrelationships of the several study tasks during the investigation is shown in Figure 5-2. Iterations will be introduced at several points during the study to insure that information which is developed at a late stage in the study is fed back to earlier stages so that the appropriate impact of such information can

TENTATIVE SCHEDULE FOR SEAMOD INVESTIGATION

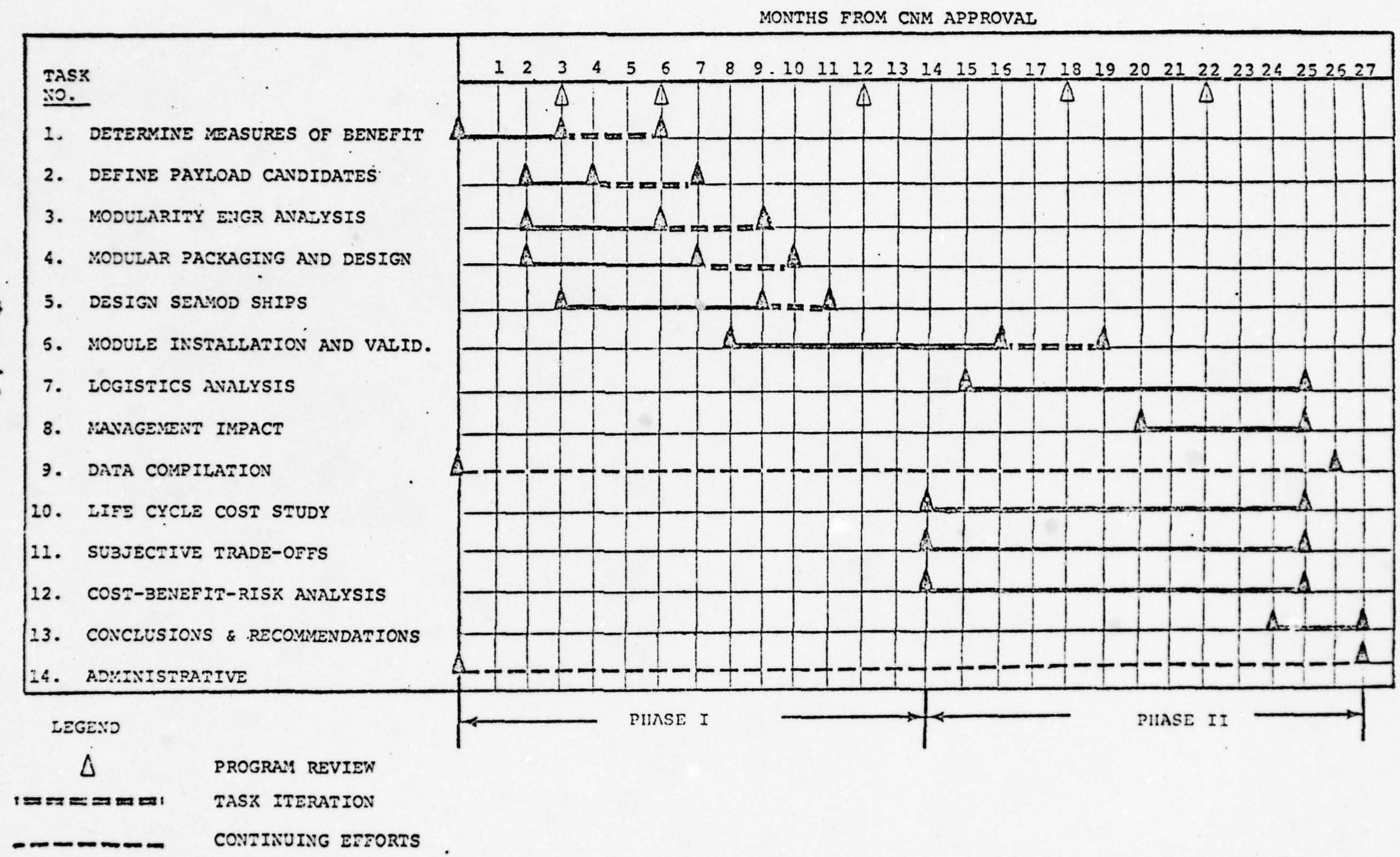



Figure 5-2

be evaluated. Efforts conducted in parallel will entail interchanges of information as tasks proceed.

### 5.3.1 Phase I

Phase I will cover in three months the completion of tasks to develop estimates of the potential military worth of the SEAMOD concept and the payload candidates appropriate for a SEAMOD configured DD-963. In addition, modularity engineering analysis and modular packaging and design will be completed deriving base data and refined concepts from Tasks 1 and 2. A SEAMOD ship design will be completed with interfacing designs and evaluations of module installation processes.

### 5.3.2 Phase II

During Phase II the critical analyses of logistics and Navy internal management will be completed. These efforts will proceed in parallel with other tasks dealing with life cycle costs, trade-offs, and cost-benefit-risk analyses. Phase II will develop value conclusions, and recommendations, for the continuation of the SEAMOD program into a prototype demonstration to include formulation of a fleet acquisition concept.

### 5.3.3 Program Reviews

Major program reviews are planned at the conclusion of three, six, twelve, eighteen, twenty-two months. These reviews are designed to provide command opportunity for injection of program guidance, and to insure that progress is satisfactory. These reviews are intended to provide the opportunity, at appropriate stages, to evaluate the continued worth of the investigation and to make decisions for continuation or termination.

## 5.4 Estimated Funding

The estimated funding required to complete the SEAMOD investigation is shown in Figure 5-3.

FUNDING ESTIMATE ($000)

| TASK (tot) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 (150) | 50 | 50 | 20 | 10 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | |
| 2 (140) | | | 40 | 40 | 30 | 20 | 10 | | | | | | | | | | | | | | | | | | | | |
| 3 (456) | | | 101 | 101 | 101 | 101 | 26 | 16 | 10 | | | | | | | | | | | | | | | | | | |
| 4 (763) | | | 127 | 127 | 127 | 127 | 127 | 64 | 32 | 32 | | | | | | | | | | | | | | | | | |
| 5 (340) | | | | 68 | 68 | 68 | 34 | 34 | 34 | 17 | 17 | | | | | | | | | | | | | | | | |
| 6 (533) | | | | | | | | | 27 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 17 | 17 | 17 | | | | | | | | |
| 7 (280) | | | | | | | | | | | | | | | | 5 | 5 | 18 | 20 | 20 | 20 | 48 | 48 | 48 | 48 | | |
| 8 (64) | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 16 | 16 | 16 | | |
| 9 (68) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 10 (288) | | | | | | | | | | | | | | | 5 | 5 | 10 | 20 | 20 | 20 | 30 | 43 | 45 | 45 | 45 | | |
| 11 (257) | | | | | | | | | | | | | | | 5 | 5 | 10 | 20 | 20 | 20 | 20 | 39 | 39 | 39 | 40 | | |
| 12 (372) | | | | | | | | | | | | | | | 10 | 10 | 20 | 20 | 20 | 20 | 20 | 63 | 63 | 63 | 63 | | |
| 13 (110) | | | | | | | | | | | | | | | | | | | | | | | | | 37 | 37 | 36 |
| 14 (144) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Monthly | 57 | 57 | 295 | 353 | 343 | 333 | 204 | 121 | 110 | 121 | 90 | 73 | 73 | 73 | 93 | 98 | 70 | 103 | 106 | 89 | 107 | 210 | 220 | 220 | 258 | 46 | 42 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cumulative | 57 | 114 | 409 | 762 | 1105 | 1438 | 1642 | 1763 | 1873 | 1994 | 2084 | 2157 | 2230 | 2303 | 2396 | 2494 | 2564 | 2667 | 2773 | 2862 | 2969 | 3179 | 3399 | 3619 | 3877 | 3923 | 3965 |

FY75 DOLLARS - OUT YEARS MUST BE ESCALATED

Figure 5-3

SEAMOD

WHAT IS IT?

VIEW GRAPH 1 - PURPOSE

SEAMOD IS AN ACRONYM FOR "SEA SYSTEMS MODIFICATION AND MODERNIZATION BY MODULARITY".

THE PURPOSE OF THE PRESENTATION IS TO FAMILIARIZE YOU WITH THE SEAMOD PROGRAM. THE PRESENTATION WILL COVER BRIEFLY THE BACKGROUND OF THE PROGRAM, TECHNICAL FEATURES OF THE CONCEPT, THE PRINCIPAL PROGRAM ISSUES, AND THE NAVSEA DEVELOPMENT PROGRAM.

10/22

## BACKGROUND

- ADVANCED CONCEPTS TEAM
- DX PROGRAM
- ASCAC PROGRAM (ANTI-SUB. C&C)
- BLOHM AND VOSS CONCEPT
- 1973 NAVSHIPS SEAMOD STUDY PROPOSAL
- 1974 NAVSEA SEAMOD STUDY PROPOSAL

VIEW GRAPH 2 - BACKGROUND

SEAMOD CONCEPT HAS BEEN UNDER CONSIDERATION FOR SOME TIME.

THE ADVANCED CONCEPTS TEAM IN 1970 EVOLVED A SHIP DESIGN CALLED "MODULAR" MADE UP OF SEVERAL HULL MODULES. CONCURRENTLY, LITTON INDUSTRIES WAS STUDYING THE APPLICATION OF MODULAR CONCEPTS TO THE DX PROGRAM. SINCE THAT TIME, THE U.S. AND FOREIGN NAVIES HAVE EXPLORED MODULAR CONCEPTS EVEN FURTHER. APPLICATIONS HAVE BEEN DEVELOPED FOR "ON-DECK" INSTALLATIONS OF WEAPONS, THE AWG-9 FIRE CONTROL SYSTEM, THE CARRIER ASCAC SYSTEM, AND OTHERS.

A DETAILED EVALUATION OF THE SEAMOD CONCEPT WAS REQUESTED BY CNM IN APRIL 1973. THE RESPONSE PROPOSED AN INVESTIGATION OF THE CONCEPT'S POTENTIAL ON A TOTAL SHIP BASIS. THIS HAS BEEN MODIFIED AND RESUBMITTED TO CNM ON 14 OCTOBER 1974.

## DEFINITIONS

- **MODULARITY:**

  *CONCEPT OF PHYSICAL AND/OR FUNCTIONAL GROUPING OF ELEMENTS OF A COMPLEX SYSTEM INTO "BUILDING BLOCKS"*

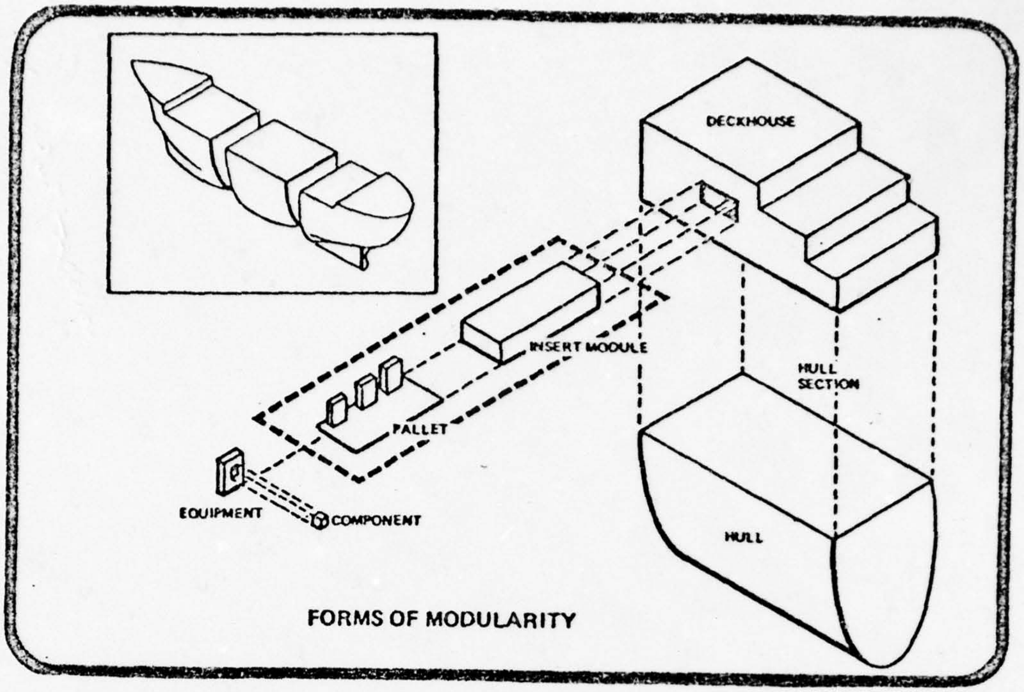
- **SEAMOD:**

  *MODULARITY APPLIED TO THE DEVELOPMENT, CONSTRUCTION, MAINTENANCE, MODERNIZATION, AND CONVERSION OF NAVAL COMBAT SYSTEMS FOR:*

  - EASE OF INTEGRATION
  - EASE OF INSTALLATION
  - EASE OF REMOVAL/EXCHANGE
  - INTERCHANGEABILITY
  - CONFIGURATION CONTROL

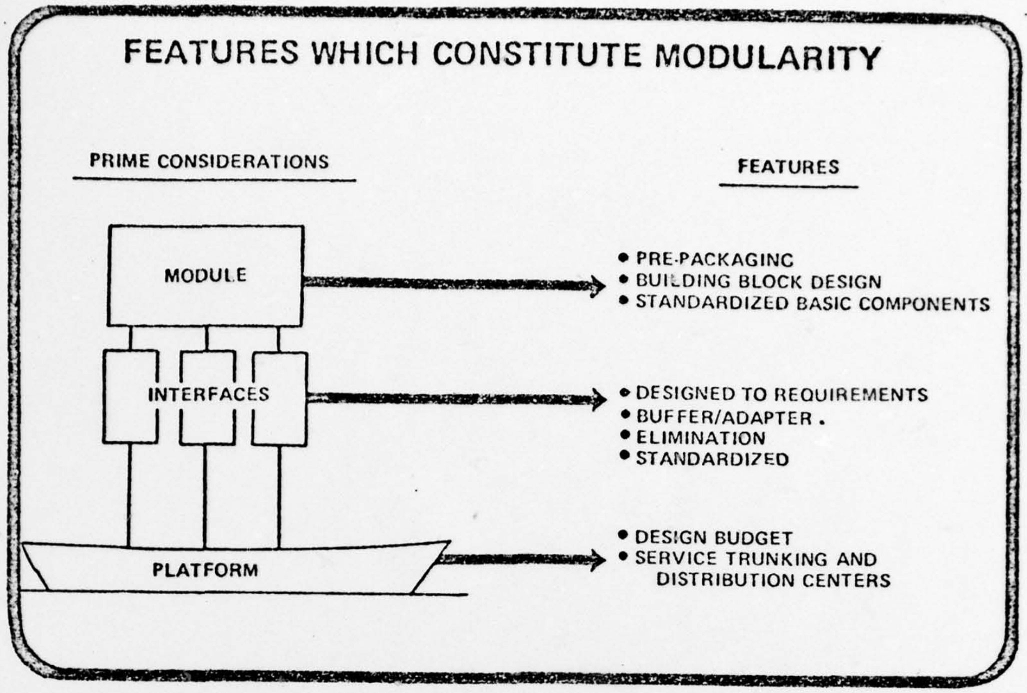
VIEW GRAPH 3 - DEFINITIONS

IN ORDER TO UNDERSTAND THE SEAMOD CONCEPT, I HAVE CHOSEN FIRST TO DEFINE MODULARITY AND THE APPLICATION THEREOF TO SEAMOD.



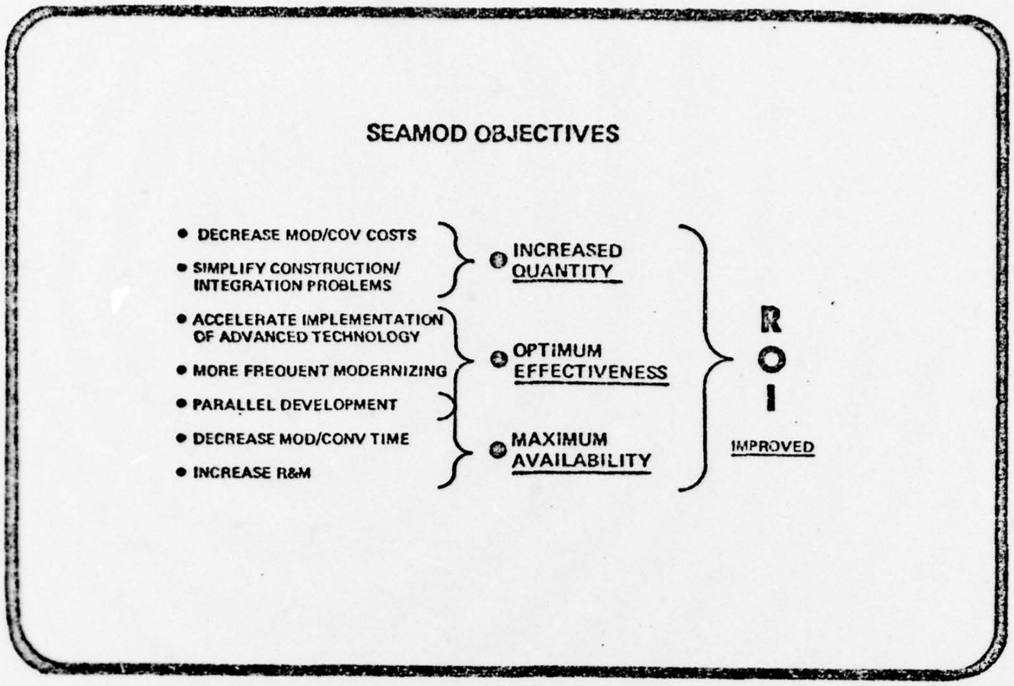

VIEW GRAPH 4 - FORMS OF MODULARITY

MODULARITY IS NOT NEW. AT ONE END OF THE SPECTRUM, LARGE HULL SECTIONS HAVE BEEN PLACED IN DRY DOCKS AND WELDED TOGETHER TO FORM ENTIRE HULLS. DECK HOUSES HAVE BEEN FABRICATED IN SHOPS AND THEN LIFTED INTO THE DRY DOCK TO BE WELDED ONTO THE HULLS. AT THE OTHER END OF THE SPECTRUM, SMALL COMPONENTS SUCH AS THOSE DEVELOPED FOR THE STANDARD HARDWARE PROGRAM ARE FITTED INTO MANY DIFFERENT EQUIPMENTS. HOWEVER, EQUIPMENTS ARE SELDOM PALLETIZED OR ASSEMBLED AS ENTIRE PAYLOAD MODULES TO BE LOADED ONBOARD A DECK OR INTO A DECK HOUSE. THIS IS THE FORM OF MODULARITY THAT SEAMOD IS CONCERNED WITH.




VIEW GRAPH 5 - FEATURES OF MODULARITY

THE MODULE DESIGN REQUIRES; PREPACKAGING, BUILDING BLOCK DESIGN FOR RAPID INSTALLATION, AND STANDARDIZED BASIC COMPONENTS FOR INTERCHANGEABILITY. INTERFACES HAVE TO BE NEGOTIATED, DESIGNED TO, AND CONTROLLED. BUFFERS AND ADAPTERS MAY BE PROVIDED WHERE NECESSARY, AND AS MANY INTERFACES AS POSSIBLE ELIMINATED. FOR INSTANCE, AIRCONDITIONING MAY BE PROVIDED BY THE MODULE MANUFACTURER. STANDARDIZED INTERFACES ARE ESSENTIAL TO REALIZE A REAL BENEFIT. PLATFORMS WOULD BE DESIGNED TO PREDETERMINE THE LOCATION OF THE PARTICULAR PAYLOAD MODULES AND SERVICE TRUNKING DISTRIBUTION CENTERS SET UP AS NECESSARY TO SUPPORT THESE.




VIEW GRAPH 6 - SEAMOD OBJECTIVES

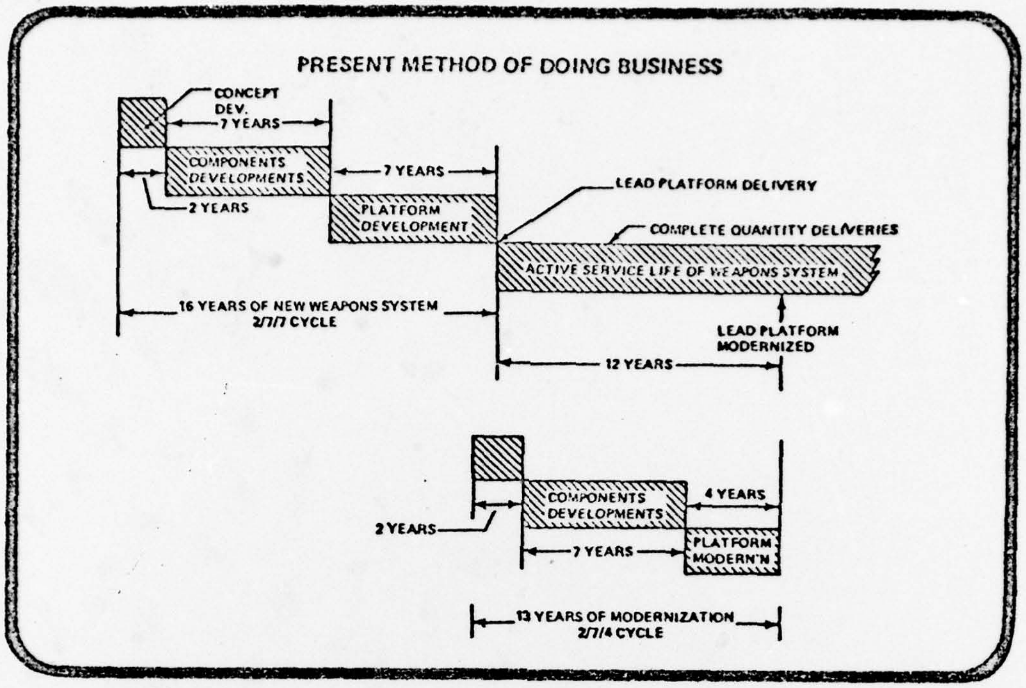
THE SEAMOD OBJECTIVES ARE TO DECREASE MODERNIZATION AND CONVERSION COSTS, SIMPLIFY SHIPBUILDING AND SYSTEM INTEGRATION, ACCELERATE IMPLEMENTATION OF ADVANCED TECHNOLOGY, ALLOW PARALLEL DEVELOPMENT OF PAYLOAD AND PLATFORM, PROVIDE FOR FREQUENT MODERNIZATION WITHOUT SHIPYARD UTILIZATION, DECREASE MODERNIZATION/CONVERSION TIME, AND INCREASE RELIABILITY AND MAINTAINABILITY VIA MODULAR SYSTEMS. OBTAINING THESE OBJECTIVES, OR SOME OF THESE OBJECTIVES, SHOULD INCREASE THE QUANTITY OF PLATFORMS OR PAYLOADS, THE EFFECTIVENESS OF THESE SHIPS, AND THE AVAILABILITY OF THESE SHIPS; ALL THIS LEADING TO IMPROVED RETURN ON INVESTMENT.

## ISSUES

- SERIAL DEVELOPMENT OF PLATFORMS AND COMBAT SYSTEMS
- LIFESPAN DISPARITY OF PLATFORMS AND COMBAT SYSTEMS
- CONTINUOUS REQUIREMENTS FOR MODERNIZATION AND CONVERSIONS

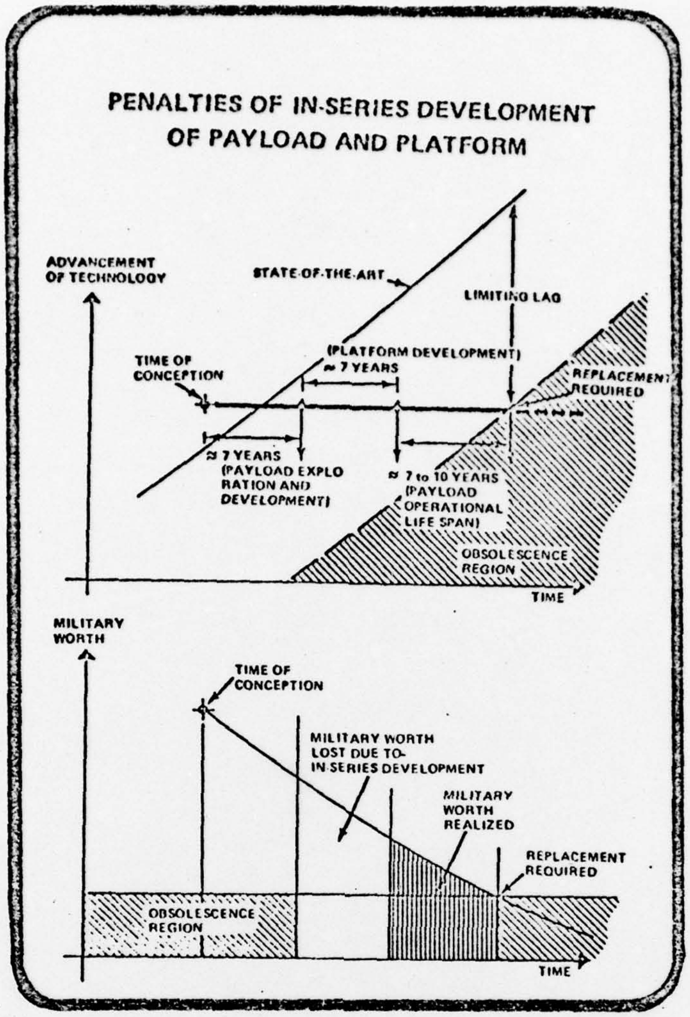
VIEW GRAPH 7 - ISSUES

THE KEY ISSUES WHICH IMPACT AND DETERMINE THE NEED TO IMPROVE ROI FOR SURFACE COMBATANTS ARE LISTED HERE. I WILL BRIEFLY DISCUSS THESE ISSUES AND SUGGEST THAT THE NAVY REEVALUATE ITS PRESENT METHOD OF DEVELOPING, BUILDING, AND MODERNIZING ITS SURFACE COMBATANTS.




VIEW GRAPH 8 - PRESENT METHOD OF DOING BUSINESS

THIS VIEW GRAPH REPRESENTS THE PRESENT WAY THE NAVY CONDUCTS ITS BUSINESS. SEVEN YEARS ARE SPENT DEVELOPING COMPONENTS FOR PAYLOADS, AND ANOTHER SEVEN YEARS ARE SPENT DEVELOPING THE PLATFORM. AFTER FOURTEEN YEARS, A PLATFORM WITH PAYLOADS IS DELIVERED. THIS SHIP HAS APPROXIMATELY A SEVEN TO TWELVE YEAR LIFE SPAN UNTIL MODERNIZATION IS REQUIRED. IT IS INTERESTING TO NOTE THAT WE USUALLY PLAN THE MODERNIZATION OF A SHIP ABOUT THE SAME TIME IT BECOMES OPERATIONAL.




VIEW GRAPH 9 - IN-SERIES PENALTIES

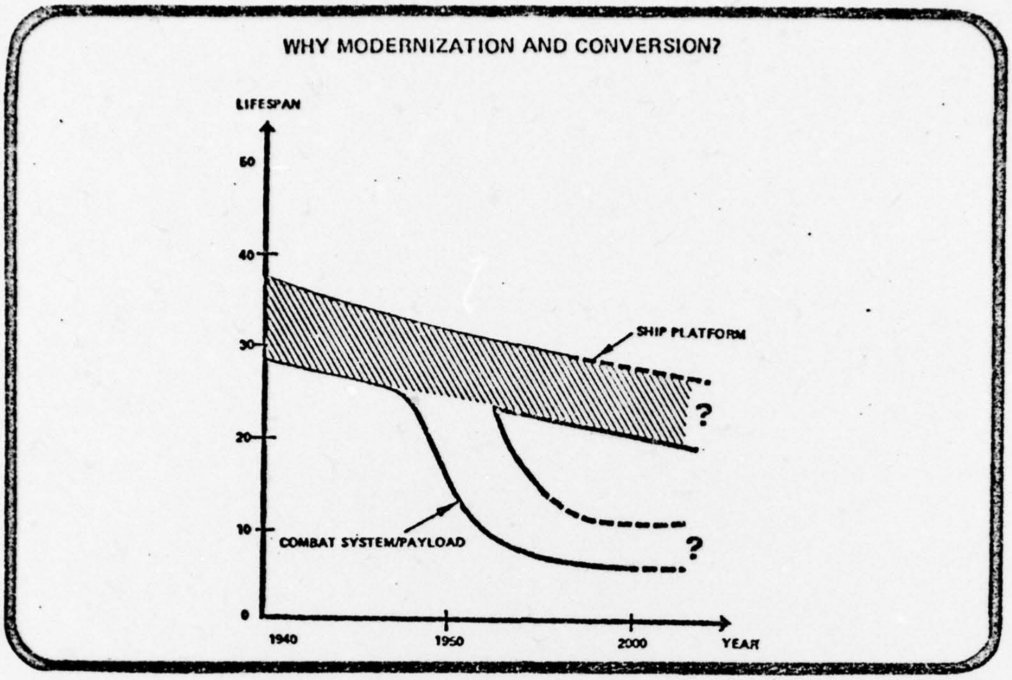
(TOP PORTION)

BECAUSE WE DEVELOP PAYLOADS AND PLATFORMS IN SERIES, WE THEORETICALLY PAY A PENALTY. PLOTTING THE ADVANCEMENT OF TECHNOLOGY VERSUS TIME FOR A SPECIFIC PAYLOAD TECHNOLOGICAL AREA SHOWS THAT TECHNOLOGY ADVANCES WITH TIME UNTIL THAT TECHNOLOGY IS OBSOLETE. SEVEN YEARS ARE SPENT DEVELOPING A PAYLOAD, ANOTHER SEVEN YEARS DEVELOPING A PLATFORM, AND THEN PAYLOAD/PLATFORM IS OPERATIONALLY AVAILABLE FOR APPROXIMATELY SEVEN TO TWELVE YEARS UNTIL REPLACEMENT OF THE PAYLOAD IS REQUIRED.

CONTINUED .....

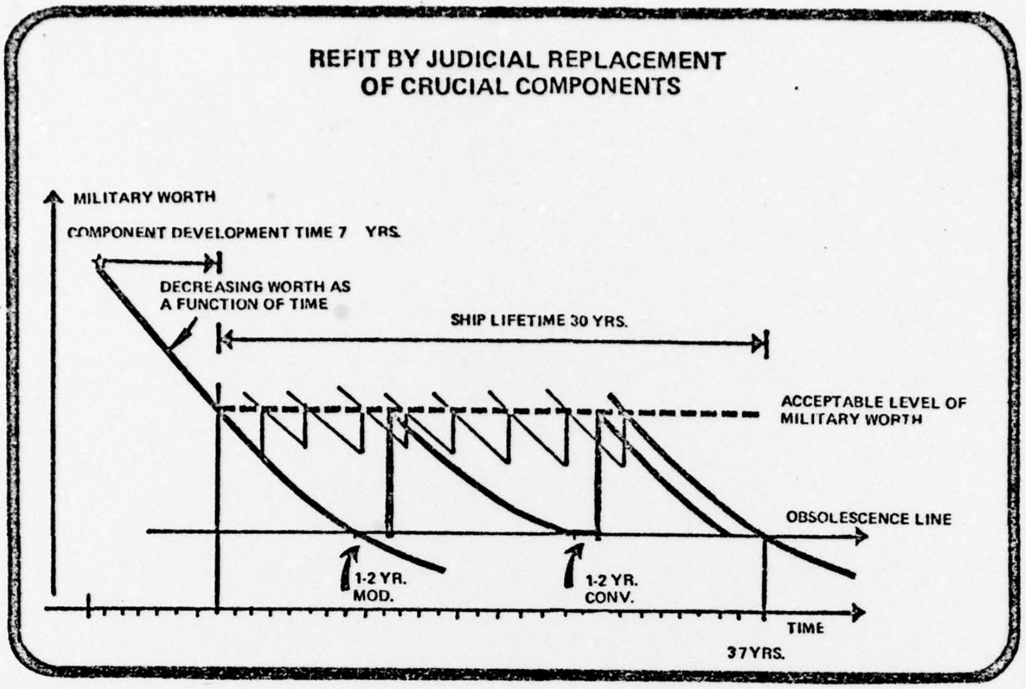
(LOWER PORTION)

PLOTTING MILITARY WORTH VERSUS TIME, THERE IS A DECREASING CURVE AS TIME GOES ON TO THE POINT WHERE THE SYSTEM IS OBSOLETE AND NEEDS TO BE REPLACED. WHEN THE PAYLOAD IS AVAILABLE, ITS MILITARY WORTH IS NOT REALIZED AND CANNOT BE REALIZED UNTIL THE PLATFORM IS AVAILABLE. THEORETICALLY, A CERTAIN AMOUNT OF MILITARY WORTH IS LOST DUE TO IN-SERIES DEVELOPMENT OF PAYLOAD AND PLATFORM. THE PENALTY IS FURTHER COMPOUNDED WHEN WE CONSIDER SERIES PRODUCTION OF SHIPS.



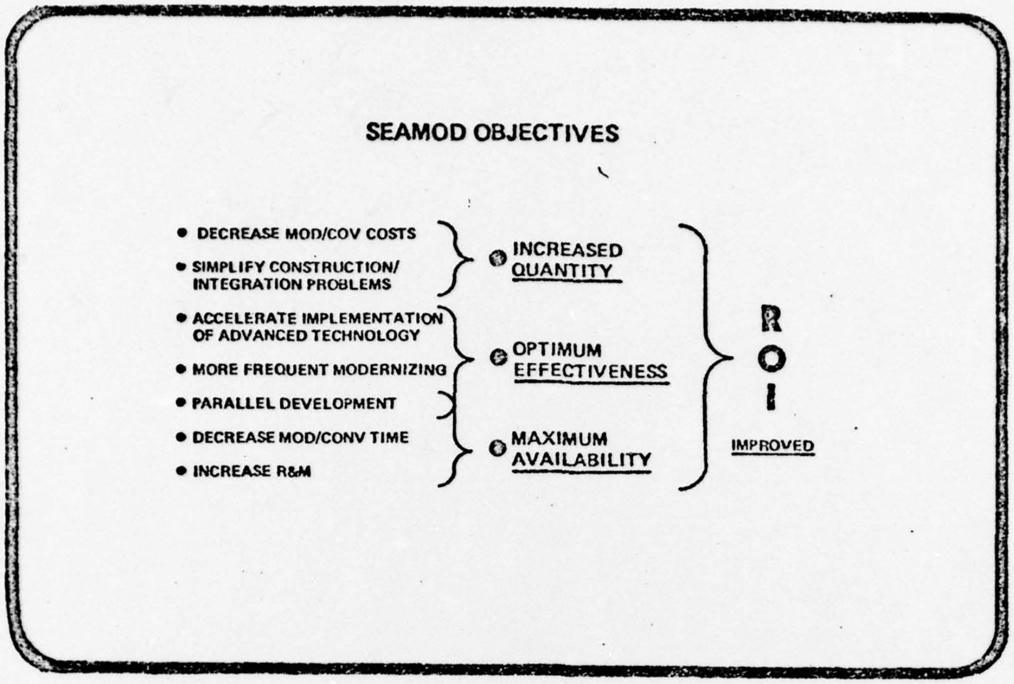

VIEW GRAPH 10 - WHY MODERNIZATION AND CONVERSION?

CONTINUOUS MODERNIZATION AND CONVERSION OF A NAVAL SURFACE COMBATANT IS REQUIRED BECAUSE OF THE LIFE SPAN DISPARITY BETWEEN THE SHIP PLATFORM AND THE COMBAT SYSTEM PAYLOAD. THE PLATFORM LASTS 25 TO 35 YEARS, WHEREAS THE COMBAT SYSTEM IS TURNING OVER AT A TECHNOLOGY PACE OF 5 TO 10 YEARS, AND IN SOME CASES, EVEN 3 TO 5.




VIEW GRAPH 11 - COMPONENT REFIT

MODULAR PAYLOADS, BECAUSE THEY WOULD BE DESIGNED TO BE RAPIDLY REPLACED, MAY PERMIT SURFACE COMBATANTS TO MAINTAIN AN ACCEPTABLE LEVEL OF MILITARY WORTH BY IMPLEMENTING ADVANCED TECHNOLOGY AS IT BECOMES AVAILABLE.




VIEW GRAPH 12 - SEAMOD OBJECTIVES

TO REITERATE, WE HOPE OUR SEAMOD STUDY WILL INDICATE AN APPROACH TO IMPROVE OUR RETURN ON OUR INVESTMENT THROUGH INCREASED QUANTITIES OF SURFACE COMBATANTS WITH OPTIMUM COMBAT EFFECTIVENESS AND MAXIMUM AVAILABILITY.

## SEAMOD DEVELOPMENT PROGRAM

- PHASE I

  *DETERMINE MEASURES OF BENEFIT AND TECHNICAL FEASIBILITY*

- PHASE II

  *COST–BENEFIT–RISK ANALYSES*

VIEW GRAPH 13 - SEAMOD PROGRAM PHASES

TO DETERMINE THE VALUE POTENTIAL OF SEAMOD CONCEPT TO HELP RELIEVE THE ISSUES OF: (1) SERIAL DEVELOPMENT OF PLATFORMS AND COMBAT SYSTEMS; (2) THEIR LIFE SPAN DISPARITY; AND (3) THE CONTINUOUS REQUIREMENT FOR MODERNIZATIONS AND CONVERSIONS, WE HAVE DEVELOPED A STUDY PLAN IN TWO PHASES. PHASE I WILL DEFINE THE BENEFITS POTENTIAL OF THE CONCEPT AND ITS TECHNICAL FEASIBILITY. PHASE II WILL DEAL WITH COST-BENEFIT-RISK ANALYSES PLUS PRELIMINARY PLANNING FOR A PROTOTYPE DEMONSTRATION. OUR TARGET DATE TO START PHASE I IS 1 JANUARY 1975.

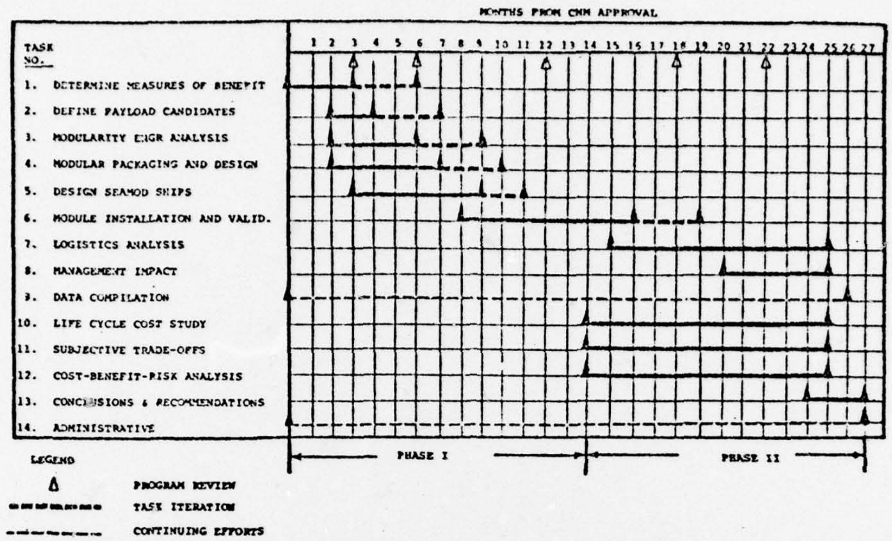
## OPNAV

- PROTOTYPE HARDWARE PROGRAM

VIEW GRAPH 14 - OPNAV REQUIREMENT

RESULTS FROM THE CNM DEVELOPMENT PLAN WILL DETERMINE THE PROGRAM FOR PROTOTYPE HARDWARE DEVELOPMENT BY OPNAV. THIS WILL INVOLVE THE DEVELOPMENT OF MODULAR PAYLOADS TO BE TESTED AND INTEGRATED AT A LANDBASED TEST SITE AND THEN INSTALLED ON A PLATFORM FOR TEST AND EVALUATION.

## TENTATIVE SCHEDULE FOR SEAMOD INVESTIGATION



## FUNDING ESTIMATE ($000)

| TASK (tot) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 (150) | 50 | 50 | 20 | 10 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | |
| 2 (130) | | | 40 | 40 | 20 | 20 | 10 | | | | | | | | | | | | | | | | | | | | |
| 3 (455) | | | 101 | 101 | 101 | 101 | 26 | 16 | 10 | | | | | | | | | | | | | | | | | | |
| 4 (763) | | | 127 | 127 | 127 | 127 | 127 | 64 | 32 | 32 | | | | | | | | | | | | | | | | | |
| 5 (340) | | | | 68 | 68 | 68 | 34 | 34 | 34 | 17 | 17 | | | | | | | | | | | | | | | | |
| 6 (533) | | | | | | | | | 27 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 17 | 17 | 17 | | | | | | | | |
| 7 (280) | | | | | | | | | | | | | | | | 5 | 5 | 18 | 20 | 20 | 20 | 48 | 48 | 48 | 48 | | |
| 8 (64) | | | | | | | | | | | | | | | | | | | | | 8 | 8 | 16 | 16 | 16 | | |
| 9 (68) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 10 (289) | | | | | | | | | | | | | | | 5 | 5 | 10 | 20 | 20 | 20 | 30 | 43 | 45 | 45 | 45 | | |
| 11 (257) | | | | | | | | | | | | | | | 5 | 5 | 10 | 20 | 20 | 20 | 20 | 39 | 39 | 39 | 40 | | |
| 12 (372) | | | | | | | | | | | | | | | 10 | 10 | 20 | 20 | 20 | 20 | 20 | 63 | 63 | 63 | 63 | | |
| 13 (110) | | | | | | | | | | | | | | | | | | | | | | | | | 37 | 37 | 36 |
| 14 (144) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Monthly | 57 | 57 | 295 | 353 | 343 | 333 | 204 | 121 | 110 | 121 | 90 | 73 | 73 | 73 | 93 | 98 | 70 | 103 | 106 | 89 | 107 | 210 | 220 | 220 | 258 | 46 | 42 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cumulative | 57 | 114 | 409 | 762 | 1105 | 1438 | 1642 | 1763 | 1873 | 1994 | 2084 | 2157 | 2230 | 2303 | 2396 | 2494 | 2564 | 2667 | 2773 | 2862 | 2969 | 3179 | 3399 | 3619 | 3877 | 3923 | 3965 |

FY75 DOLLARS - OUT YEARS MUST BE ESCALATED

IN CONCLUSION SEAMOD ADVANCES A NEW CONCEPT WHICH MAY IMPACT THE NAVY'S CURRENT METHODS OF SHIPBUILDING AND MODERNIZATION. IT MAY ENHANCE SHIP CONSTRUCTION BY PERMITTING COMPLETION OF THE HULL PRIOR TO DELIVERY OF MODULAR PAYLOADS, AND REDUCE OVERHAUL PERIODS IF STANDARD INTERFACE AND RAPID REFIT CAPABILITIES ARE REALIZED. THE CONCEPT MAY PERMIT MORE REALISTIC SHORESIDE TRAINING OF PERSONNEL AND MORE EFFICIENT IOT&E. THE CONCEPT MAY ALSO LEAD TO INDEPENDENT DEVELOPMENT OF MODULAR PAYLOADS NOT ASSOCIATED WITH A SPECIFIC HULL DESIGN.